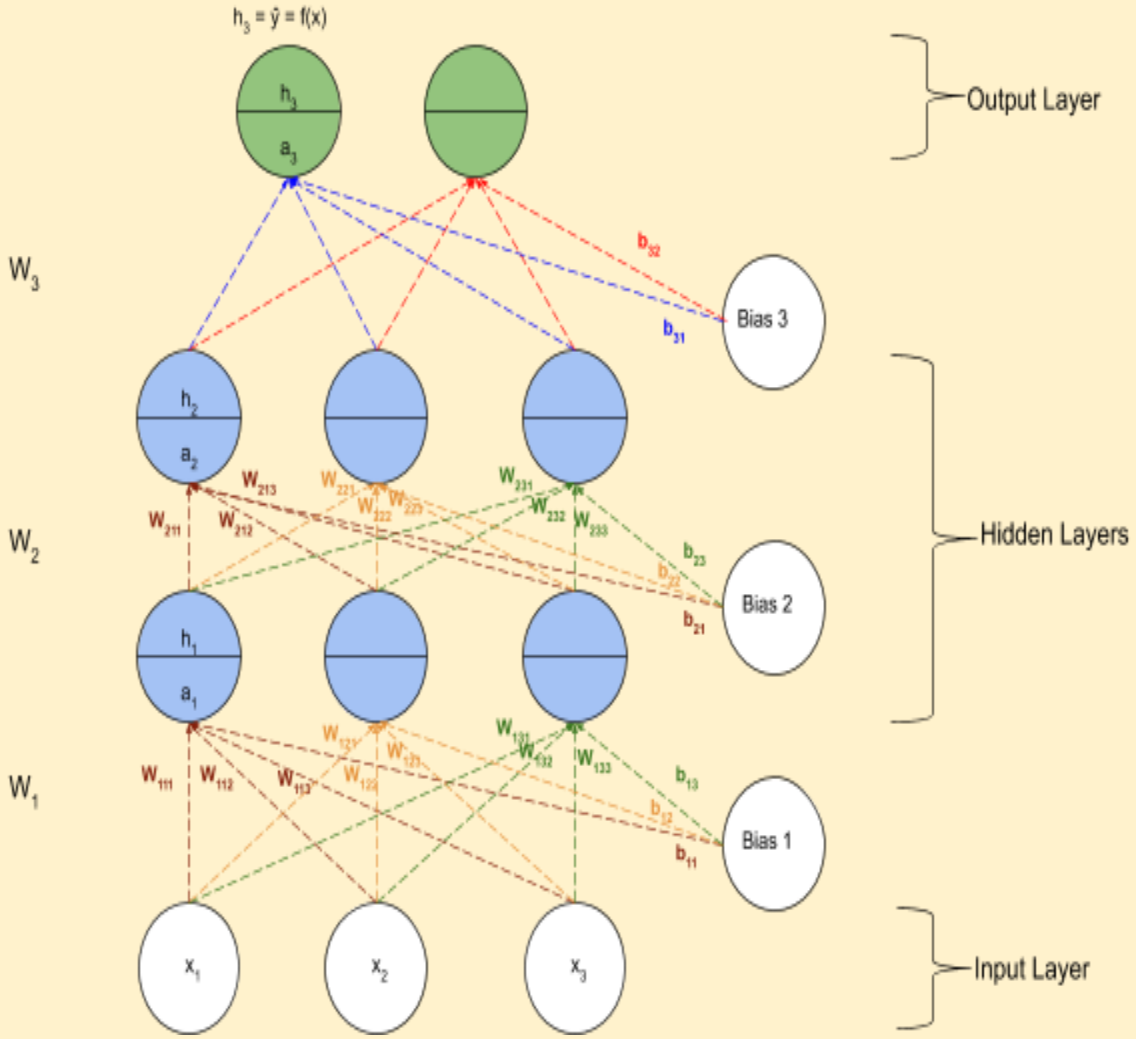
PadhAI: Deep Neural Networks

One Fourth Labs

Understanding the Computations in a Deep Neural Network

Let's look at the computations inside a DNN

1. Consider the same DNN drawn in the previous section



2. The preactivation outputs for the first layer a_{11}, a_{12} a_{13}, are calculated using simple Matrix-vector multiplication

$$W_1 = \begin{bmatrix} w_{111} & w_{112} & w_{113} \\ w_{121} & w_{122} & w_{123} \\ w_{131} & w_{132} & w_{133} \end{bmatrix} \quad X = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

3. Here, the preactivation values are as follows
   a. $a_{11} = w_{111} * x_1 + w_{112} * x_2 + w_{113} * x_3 + b_{11}$
   b. $a_{12} = w_{121} * x_1 + w_{122} * x_2 + w_{123} * x_3 + b_{12}$
   c. $a_{13} = w_{131} * x_1 + w_{132} * x_2 + w_{133} * x_3 + b_{13}$
   d. These values are just the individual rows of the dot-product between W_1 and X plus the bias vector
   e. Thus $W_1X = a_1$ is given by

$$a_1 = \begin{bmatrix} a_{11} \\ a_{12} \\ a_{13} \end{bmatrix}$$

   f. Here, $W_1 \in \mathbb{R}^{3\times3}$, $X \in \mathbb{R}^{3\times1}$, and $W_1X \in \mathbb{R}^{3\times1}$
   g. $a_i = W_i$
4. The activation values are as follows
   a. $h_i = g(a_i)$
   b. They are simply the result on applying the activation function (in this case: sigmoid) on the preactivated values
   c. $h_{11} = \frac{1}{1+e^{-(a_{11})}}$
   d. $h_{12} = \frac{1}{1+e^{-(a_{12})}}$
   e. $h_{13} = \frac{1}{1+e^{-(a_{13})}}$